EPJ Web of Conferences 2014 vol.64

On the origin of cyclotron lines in the spectra of X-ray pulsars

Mushtukov A., Poutanen J., Suleimanov V., Tsygankov S., Nagirner D., Doroshenko V., Lutovinov A.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Cyclotron resonance scattering features are observed in the spectra of some X-ray pulsars and show significant changes in the line energy with the pulsar luminosity. In a case of bright sources, the line centroid energy is anti-correlated with the luminosity. Such a behaviour is often associated with the onset and growth of the accretion column, which is believed to be the origin of the observed emission and the cyclotron lines. However, this scenario inevitably implies large gradient of the magnetic field strength within the line-forming region, and it makes the formation of the observed line-like features problematic. Moreover, the observed variation of the cyclotron line energy is much smaller than could be anticipated for the corresponding luminosity changes. We argue that a more physically realistic situation is that the cyclotron line forms when the radiation emitted by the accretion column is reflected from the neutron star surface. The idea is based on the facts that a substantial part of column luminosity is intercepted by the neutron star surface and the reflected radiation should contain absorption features. The reflection model is developed and applied to explain the observed variations of the cyclotron line energy in a bright X-ray pulsar V 0332+53 over a wide range of luminosities.

http://dx.doi.org/10.1051/epjconf/20136402005